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NOTES ON

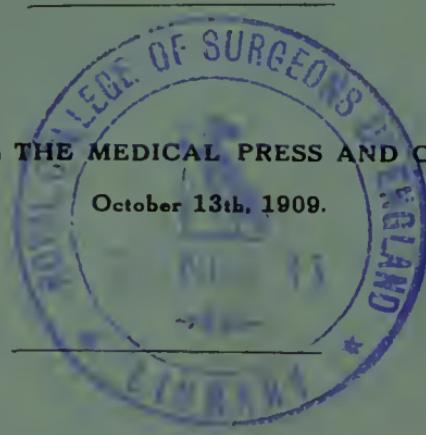
Hæmorrhagic Diphtheria.

BY J. D. ROLLESTON, M.D., B.CH.OXON,

Assistant Medical Officer to the Grove Hospital, Metropolitan Asylums Board,
London.

Reprinted from THE MEDICAL PRESS AND CIRCULAR,

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BAILLIERE, TINDALL AND COX,

8 HENRIETTA STREET, COVENT GARDEN.

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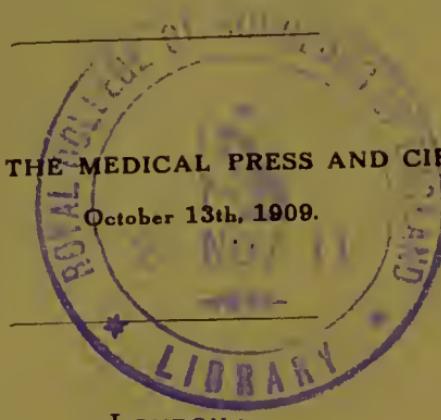
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HÆMORRHAGIC DIPHTHERIA.

Definition.—In the present paper the term hæmorrhagic diphtheria is applied to those cases in which in addition to other signs of malignancy hæmorrhages appear in the skin at an early stage of the disease, with or without hæmorrhages from the mucous membranes.

The insertion of the words "at an early stage" has been made so as to exclude cases of purpura occurring in convalescence from diphtheria such as have been described by Buckley, (a) Goodall, (b) and Barlow. (c) The qualification "in addition to other signs of malignancy" has been used because petechiae may sometimes develop at the injection sites in cases which are not remarkably severe. These lesions which are usually scanty and minute have no evil significance. Cases in which epistaxis alone occurred, though accompanied by other features of malignancy, have not been dignified with the title of hæmorrhagic diphtheria, nor has the term been applied to malignant cases in which hæmorrhage occurred from beneath the faucial membrane alone.

It is sometimes difficult to determine whether a hæmorrhage is spontaneous, or is due to some slight mechanical cause. It is perhaps best to follow Sevestre, (d) who maintains that the lesion is always disproportionate to the local agent. Thus a bruise may appear over the knee after a light percussion of the extensor tendon, or over a rib after auscultation of the chest.

Frequency.—The present paper is based on 1,550 cases of diphtheria which have been under my care at the Grove Hospital in the course of the last six years. Of these, 78 or 5.03 per cent. were hæmorrhagic.

Classification.—The cases have been divided into two groups. *A.* Those in which the hæmorrhages involved both the skin and the mucous membranes

(a) *Laneet*, II., 1901, p. 132.

(b) *Ibidem*, p. 1492, and "Guy's Hosp. Rep.", 1894, Vol. L., p. 91.

(c) M.A.B. Reports, 1901.

(d) In Comby's "Traité des mal. de l'enf." Tome 1, 1904, p. 112, art. Diphthérie.

(53 cases). *B.* Those in which the skin only was affected (25 cases).

Age and Sex.—23, or 4.1 per cent. occurred in the first quinquennium; 50, or 7.02 per cent. in the second; and 5, or 3.4 per cent. in the third. The oldest patient affected was aged 12 years, though 167 of the 1,550 were above that age. 31 or 4.2 per cent. were males; 47 or 5.7 per cent. were females.

Seasonal incidence.—The following figures show that hæmorrhagic cases are almost equally frequent at all periods of the year. Thus 20 or 4.4 per cent. occurred in the first quarter, 14 or 6.03 per cent. in the second, 13 or 4.1 per cent. in the third, and 31 or 5.6 per cent. in the fourth.

Table I. shows that with two exceptions the annual percentage of hæmorrhagic cases has remained practically the same since 1902. The year 1903, for which the Grove Hospital diphtheria case mortality was only 6.0 per cent., was exceptional for its small number of malignant cases. The patients of 1908 cannot fairly be compared with those of the other years, since they represent an unusually large proportion of young children.

TABLE I.

Year.	Total number of cases.	Hæmorrhagic		Percentage.
		cases.	Percentage.	
1902	168	10	5.9	
1903	318	9	2.8	
1904	200	11	5.5	
1905	187	10	5.3	
1906	306	16	5.12	
1907	295	15	5.08	
1908	76	7	9.2	
	—	—		
	1550	78		

Previous health.—Hæmorrhagic diphtheria in the present series did not show a special tendency to attack weakly children, or those debilitated by a recent illness, as some writers have noted. In none of the cases was any other disease, such as scarlet fever or measles co-existent with diphtheria, 13 had had no previous illness whatever. The others had had one or more of the acute exanthemata, or a previous history of sore throat or bronchitis.

Character of diphtherial attack.—In all the cases the faecal membrane was extensive, and one or more of the characteristic features of malignancy were present, such as faecal and palatal oedema, foetor, disproportionate adenopathy, pitting of the skin over the glandular swelling, and absence of, or a delay in,

reaction to antitoxin. Sixty-eight cases, or 87.3 per cent., showed signs of nasal involvement either by membrane visible within the nasal fossæ or by profuse and thick rhinorrhœa. Only 4 had laryngeal symptoms. Two of them required tracheotomy. All 4 died. Enlargement of the liver appreciable during life was found in 32 cases out of 57 hæmorrhagic cases, in whom it was investigated, *i.e.*, in 51.6 per cent. as compared with a percentage of 7.4 among 1,170 diphtheria patients in whom a routine examination of the liver was made. A punctate rash on the knees described by Marfan (*a*) as characteristic of severe diphtheria, occurred in 11 out of 48 hæmorrhagic cases in which this sign was investigated. Albuminuria was present in every case in which a specimen of urine could be obtained. Complete suppression of urine for 24 hours or more before death occurred in 24 cases, and pronounced oliguria in another 8. With the exception of 39 cases who died of toxæmia during the acute stage, every hæmorrhagic patient suffered from paralysis. It is of neurological interest, as indicating the perturbation of the pyramidal system met with in severe diphtheria, that Babinski's sign was present in 17 out of 38 hæmorrhagic cases, *i.e.*, in 44.7 per cent., as compared with a percentage of 19.1 in a series of 636 cases of diphtheria in which this sign was investigated.

Day of disease on admission to hospital.—Table II. shows the day of disease on admission to hospital, which in all but 3 cases was the same as that on which antitoxin was first injected.

TABLE II.

			Percentage frequency among all cases	
	Cases.	admitted.		
1st day	0	0
2nd „	3	0.9
3rd „	14	3.4
4th „	22	6.8
5th „	20	9.6
6th „	10	9.6
7th „ and later	9	7.5
<hr/>				

Thus no hæmorrhagic cases occurred among those injected on the first day, the percentage among second day cases was small, and the frequency progressively increased with delay in administration of antitoxin.

(a) "Bull. et mém. de la Soc. Méd. des Hôp. de Paris," 1902, p. 722.

The diminished frequency of hæmorrhagic cases admitted after the sixth day is probably to be explained by the fact that only a small number of untreated hæmorrhagic cases survived after that date. Occurrence of hæmorrhages in those treated comparatively early is to be attributed to a precocious malignancy of the disease and finds a striking parallel in certain rare cases of syphilis in which early adoption of specific treatment does not prevent the disease running a severe and rapidly fatal course (*vide MEDICAL PRESS AND CIRCULAR. I., 1907, p. 307*, in which I have reported a case of this kind). Of the three cases who had been injected before admission, one had received 2,000 units at home on the third day, was admitted on the fourth, and died on the ninth day of disease. The second had received 2,000 units on each of the sixth and seventh days, was admitted on the seventh, and died on the eleventh day. The third had received 1,700 units at home on the fourth day, was admitted the same day and died on the twelfth day.

Relation to antitoxin.—Table III. shows the total amount of antitoxin given in each case. As a rule injection was not made more than once daily, the maximum dose at one time rarely exceeding 24,000 units. The subcutaneous method only was adopted.

Comparative observations of intravenous injection have not convinced me that it possesses any merits to outweigh its obvious disadvantages.

TABLE III.

Doses.	Cases.	Remarks.
15,000 units ..	1	Died on day after admission.
18,000	5	1 died " " "
20,000	2	
21,000	3	2 died on day after admission.
24,000	10	{ 6 and 1 on day of admission.
30,000	2	
33,000	4	2 recoveries.
36,000	6	1 recovery.
39,000	4	3 recoveries.
40,000	1	
42,000	4	
44,000	1	
45,000	2	1 recovery.
48,000	23	3 recoveries.
52,000	1	recovery.
60,000	2	
62,000	1	
63,000	2	1 recovery.

TABLE III.—*Continued.*

Doses.	Cases.	Remarks.
66,000 units ..	1	
72,000 ..	3	1 recovery.]
	—	
	78	

These figures show that, though very large doses may not avert a fatal issue, out of 22 cases who received less than 33,000 units, none recovered. In spite of the enormous doses employed, no untoward effects attributable to serum were observed. As is the rule in severe diphtheria, the ordinary sequelæ of serum treatment were much less frequent than usual. Among the 65 fatal cases only 4 developed urticaria, though 16 lived more than a week after injection. Though all the survivors developed urticaria, no case exhibited the late syndrome of circinate erythema, pyrexia, adenitis, joint pains, and angina redux. For purposes of comparison it may be stated that of 1,492 cases injected, 987 or 66.1 per cent. had urticaria, and 281 or 18.8 per cent. circinate erythema.

Sites of hæmorrhages.—Table IV. shows the distribution of the skin hæmorrhages:—

Facc ..	..	10 cases.	Other parts of	
Neck ..	..	13 "	abdomen	5 cases.
Thorax ..	..	7 "	Ilium ..	19 "
Abdomen—			Lumbar verte-	
Injection			bræ ..	15 "
sites ..	..	28 "	Sacrum ..	6 "
<i>Upper limbs—</i>			<i>Lower limbs—</i>	
Upper arms ..	..	5 cases.	Thighs ..	20 cases.
Forearms ..	..	16 "	Legs ..	28 "
Hands ..	..	4 "	Feet ..	5 "

Hæmorrhages from mucosæ.—Hæmorrhage from the nasal mucosæ was by far the most frequent, being met with in 44 cases. Bleeding from the lips, tongue or gums occurred in 16, and from the fauces in 9. In only 2 was there hæmaturia. Sub-conjunctival hæmorrhage, so frequently seen in hæmorrhagic small-pox, occurred in only 1 case. Hæmorrhage from the genital mucosæ, which is also frequent in small-pox, was not observed.

Internal hæmorrhages.—The earlier the death the more likely are hæmorrhages to be found in the cellular tissue, muscles, serous membranes, and viscera. An autopsy was held in 27 cases. In 7 no internal hæmorrhages whatever were found. It is probable that in some of them hæmorrhages had existed, but had been absorbed before death. Hæmor-

rhages in the cervical and retropharyngeal cellular tissue were constant in cases which had died early. Intramuscular haemorrhages, extending in the abdominal wall from the injection sites up to the thorax and downwards into the pelvis, were also almost invariable in early cases.

Subpericardial haemorrhages were found in 17 cases, subpleural in 10, and subperitoneal in 7. Haemorrhages into the suprarenals were seen in all the cases in which they were examined. Haemorrhages beneath the gastric mucous membrane were noted in 9 cases, and intrapulmonary haemorrhages in 3.

Date of occurrence of haemorrhages.—Table V. shows the day of disease on which the haemorrhages were first noted.

TABLE V.

3rd day	..	3 cases.	9th day	..	4 cases.
4th	"	6	"	10th	" .. 2 "
5th	"	23	"	14th	" .. 1 case.
6th	"	17	"		—
7th	"	15	"	Total	.. 78 cases.
8th	"	7	"		

Thus 64 occurred in the first week, 14 in the second week, and the great majority—55 cases—between the 5th and 7th days.

Mortality.—Of the 78 cases, 65 died—a mortality of 83.3 per cent. This high figure can best be appreciated by comparing it with the total mortality of the 1,550 cases, which was 8.0 per cent. (124 deaths). Among 53 cases in which both skin and mucosæ were involved there were 43 deaths; 6 in this class showed petechiae and epistaxis only. Of these, 3 recovered. Among 25 cases in which the skin only was involved there were 22 deaths. Seven, all of which were fatal, showed both bruises and petechiae; 6, of which 5 died, had petechiae only, the remaining 12, of which 10 died, had bruises only.

Date of death.—The great majority died in the week comprised between the 6th and 12th days, namely: 24 in first week, 34 in second week, 5 in third week.

In 39 or 60.0 per cent. of the fatal cases, death took place from toxæmia, while the faacial membrane was still present, before paralysis had had time to develop. The remaining 26 died after the membrane had disappeared; in 24 of these death was due to cardiac paralysis, which had first developed before the beginning of the third week, and was associated in 21 cases with precocious paralysis of the palate. One died of broncho-pneumonia on the 30th day. The remaining fatal case was the only one which

showed any other paralysis than that of the heart and palate.

A girl, aet. 4, was admitted on October 7, 1905, on the 14th day of disease. There was considerable superficial necrosis of epithelium of soft palate and left tonsil. Small patch of membrane on uvula. Thick nasal discharge. Petechiae on chest and right shoulder. Knee- and ankle-jerks active. 18,000 units. Adrenalin chloride m. x., 4 hourly.

15th day. Throat clean. Epistaxis. Lips bleeding. Bruises over sacrum and posterior iliac spines. A few fresh petechiae on chest.

16th day. Two fresh bruises on right forearm, and one over lumbar vertebræ. More petechiae on thighs. Still epistaxis.

17th day. Cardiac arrhythmia and enlargement of liver.

20th day. Nasal voice.

33rd day. Ciliary palsy. Knee- and ankle-jerks lost.

35th day. Squint.

49th day. Pharyngeal and labial palsies.

50th day. Diaphragmatic palsy.

52nd day. Death. Albuminuria was present from admission till death.

In 24 of the 65 fatal cases death occurred within 24 hours of the first occurrence of skin haemorrhage. Among the remainder death took place at the following dates :—

TABLE VI.

Date of death.

	2 days after occurrence	15 cases.
3 "	"	"	..	4 "
4 "	"	"	..	4 "
5 "	"	"	..	2 "
6 "	"	"	..	5 "
7 "	"	"	..	4 "
8 "	"	"	..	3 "
10 "	"	"	..	2 "
21 "	"	"	..	1 case.
38 "	"	"	..	1 "

Austen and Cogill (*a*) in their analysis of 58 cases of haemorrhagic diphtheria state that with the exception of two cases which lived till the 9th and 11th days after the appearance of haemorrhages, all died within 48 hours, 30 dying within 24 hours. Antitoxin had been given in only 12 cases, 6 of which were moribund on admission. Similar testimony as to the rapidity of death in pre-antitoxin times is given by MacCombie. My own figures show that life in many cases may be

prolonged, and in a few saved by the employment of large doses of antitoxin.

Short histories of the cases which recovered will now be given.

CASE 1.—Girl, æt. 5, admitted October 19th, 1902, on 4th day of disease. State on admission: Fauces very œdematosus. Membrane covers enlarged tonsils, pillars and uvula, and extends on to soft palate. Much adenopathy. Profuse watery nasal discharge. Kneec-jerks absent. 18,000 units.

5th day. Membrane as yesterday. Marked foetor. Nasal discharge thicker, more profuse and sanguous. Adenopathy increased. Bruise over right anterior superior iliac spine. 15,000 units. Adrenalin chloride solution m. v., 4 hourly.

6th day. Throat slightly cleaner. Two fresh bruises over lumbar vertebrae.

10th day. Throat clean.

11th day. General urticaria for one day only.

16th day. Heart shows triple rhythm. Irregularity of force and rhythm lasted till 45th day.

33rd day. Nasal voice.

41st day. Ciliary palsy lasting till 58th day.

43rd day. Late tonsillitis.

47th day. Squint.

54th day. Allowed to sit up.

She walked badly for some days after first getting up in clothes. On her discharge from hospital on the 79th day her kneec-jerks were still absent.

CASE 2.—Boy, æt. 4, admitted December 29th, 1902, on 3rd day of disease. State on admission: Fauces and palate œdematosus. Tonsils meeting and covered by membrane which invades soft palate. Profuse watery nasal discharge. Stertor and foetor. Bruises on right shoulder and right leg. 18,000 units.

4th day. Membrane of same distribution. Fauces less œdematosus. Bleeding from gums. Two bruises over lumbar vertebrae. 15,000 units. Adrenalin m. v., 4 hourly.

7th day. Albuminuria lasting till 28th day.

10th day. Throat clean.

13th and 14th days. General urticaria.

15th day. Cardiac dilatation lasting till 58th day.

27th day. Palatal and ciliary palsies.

5th week. Pharyngeal and diaphragmatic palsies.

6th week. Paralysis of vesical sphincter.

7th week. Labial palsy and weakness of neck muscles.

8th week. Up in clothes but paraplegic for more than a fortnight.

Discharged after 81 days' stay in hospital.

CASE 3.—Boy, æt. 5, admitted January 3rd, 1903, on 3rd day of disease. State on admission: Dirty membrane covers swollen tonsils, pillars, and part of soft palate. Considerable adenopathy. Profuse and thick nasal discharge. 18,000 units.

4th day. Uvula covered by membrane. Blood-stained nasal discharge. 18,000 units. Adrenalin chloride solution m. v., 4 hourly.

5th day. Numerous petechiæ at second injection site.

7th day. Epistaxis. Albuminuria lasting till 26th day.

9th day. Throat clean.

10th–13th days. Urticaria on trunk and limbs.

20th–43rd days. Cardiac dilatation.

21st day. Palatal palsy.

25th day. Ciliary palsy.

52nd day. Scarlet fever, without complications.

Discharged after 96 days in hospital.

CASE 4.—Boy, æt. 10 $\frac{1}{2}$, admitted January 28th, 1903, on 6th day of disease. State on admission: Fauces and palate œdematosus. Membrane covers both tonsils and pillars and part of soft palate. Proconsular neck. Marked fœtor and stertor. Petechiæ on neck and left upper arm. No knee-jerks. Albuminuria lasting till 35th day. 21,000 units. Adrenalin chloride m. v., 4 hourly.

7th day. Fauces as yesterday. Considerable œdema of cellular tissue spreading from neck down to the level of the nipples.

8th day. Bloodstained nasal discharge.

9th day. Numerous petechiæ scattered all over the abdomen. Large haematoma at second injection site.

9th–11th and 14th–16th days. General urticaria.

12th day. Cardiac dilatation and irregularity which persisted during stay in hospital.

13th and 17th days. Nausea and vomiting.

30th–57th days. Ciliary palsy.

39th–55th days. Palatal palsy.

60th day. Allowed to sit up.

Walking was unsteady for the first fortnight that he was up. On his discharge after 77 days in hospital the knee-jerks were still absent.

CASE 5.—Boy, æt. 3, admitted February 22nd, 1903, on 6th day of disease. State on admission: Fauces œdematosus. Membrane on tonsils and pillars. Profuse nasal discharge. Albuminuria which persisted till 21st day. 18,000 units.

7th day. Profuse epistaxis. Bruises at injection site. Numerous petechiæ scattered all over abdomen

and on legs, 27,000 units. Adrenalin chloride solution m. x., 4 hourly.

9th day. Bruises on right forearm. 12th-16th days. General urticaria.

12th-25th days. Vomiting associated with cardiac dilatation and irregularity.

Palatal and ciliary palsies developed in the 4th week and pharyngeal, diaphragmatic, and labial palsies in the 5th week. He was allowed to sit up on the 65th day, but it was another month before he could walk at all well.

He was discharged after 96 days in hospital.

CASE 6.—Boy, æt. 5½, admitted January 20th, 1904, on 5th day of disease. State on admission: Dirty membrane covers tonsils and pillars, part of posterior pharyngeal wall and soft palate. Sanguous nasal discharge. Well-marked bilateral adenopathy. Petechiae in right groin. 21,000 units. Adrenalin chloride solution m. v., 4 hourly.

6th day. Membrane of same distribution. Nasal discharge no longer blood-stained. 21,000 units.

7th day. Albuminuria which persisted till 35th day. 21,000 units.

8th day. Throat clean. Liver edge 2 fingers' breadth below costal margin.

14th-20th days. General urticaria.

14th-18th days. Cardiac irregularity.

20th day. Ciliary palsy lasting till 53rd day.

24th day. Palatal palsy, also gone by 53rd day.

49th day. Sat up. For 11 days after getting up he had some difficulty in walking.

Discharged after 79 days in hospital.

CASE 7.—Boy, æt. 2½, admitted February 18th, 1904, on 5th day of disease. State on admission. Old thin membrane on both tonsils, pillars, uvula and epiglottis. Watery nasal discharge. Albuminuria lasting till 50th day. 18,000 units. Adrenalin chloride m. v., 4 hourly.

6th day. Membrane of same distribution. Bruises on legs and on left posterior superior iliac spine. 21,000 units. Adrenalin chloride increased to 2 hourly doses.

7th day. Epistaxis.

8th day. Throat clean.

17th-18th days. General urticaria.

32nd day. Palatal and labial palsies.

35th day. Pharyngeal palsy. Cutaneous analgesia. Knee-jerks and abdominal reflexes lost.

38th day. Squint and ptosis.

48th-56th days. Cardiac dilatation.

When propped up on the 56th day well-marked

palsy of the neck muscles was present. Loss of power in the lower limbs persisted for more than a month after getting up. Discharged after 99 days in hospital.

Case 8.—Boy, æt. 1 year 10 months, admitted July 4th, 1904, on 6th day of disease. State on admission: Membrane on both tonsils and anterior pillars. Profuse watery nasal discharge. Moderate adenopathy. 18,000 units. Adrenalin chloride m. v., 4 hourly.

7th day. Membrane of same distribution. Marked foetor. Adenopathy increased. Epistaxis. 21,000 units. Adrenalin increased to 2 hourly doses.

8th day. Petechiae on thighs. Bruise over lumbar vertebrae.

9th day. Bruise just internal to inferior angle of right scapula.

10th and 11th days. Epistaxis.

11th day. Slight enlargement of liver.

13th day. Throat clean.

14th day only. A few wheals of urticaria.

15th day. Albuminuria.

20th day. Palatal palsy.

24th-6th days. Cardiac dilatation and irregularity.

39th day. Squint.

56th day. Allowed to sit up. Paraplegia for a fortnight after first sitting up. No knee- nor ankle-jerks on his discharge after 81 days' stay in hospital.

CASE 9.—Girl, æt. 7, admitted December 14th, 1904, on 4th day of disease. State on admission: Fauces oedematous. Membrane covers tonsils, pillars and uvula. Some deposit on epiglottis. Proconsular neck. Bruise over left internal malleolus. 24,000 units. Adrenalin m. v., 2 hourly.

5th day. Membrane of same distribution. Foetor marked. Bruise on right knee. 24,000 units.

6th day. Membrane still of same distribution. Albuminuria lasting till 33rd day. 24,000 units.

9th day. Punctate rash on knees.

10th-14th days. General urticaria.

11th day. Throat clean.

17th day. Palatal palsy.

22nd-42nd days. Cardiac dilatation and irregularity.

26th day. Ciliary palsy.

39th day. Labial palsy.

56th day. In clothes. No loss of power in limbs, but knee- and ankle-jerks absent. Discharged after 62 days' stay in hospital.

CASE 10.—Boy, æt. 4, admitted December 23rd, 1904, on 4th day of disease. State on admission: Fauces and palate oedematous. Membrane covers

both tonsils, pillars, and tip of uvula. Profuse nasal discharge. Membrane visible in nasal fossæ. Moderate adenopathy. Stertor and foetor. Petechiæ round neck. 24,000 units. Adrenalin chloride m. v., 2 hourly.

5th day. Fauces still œdematos. Foetor and stertor increased. Thick cloud of albumin in urine lasting till 40th day. 24,000 units.

6th day. Several fresh petechiæ on neck. A few on scapulæ. Bruise at second injection site.

7th day. Numerous fresh petechiæ on neck, back, buttocks and legs. Liver 2 fingers' breadth below costal margin. Throat clean.

11th-15th days. Urticaria.

14th day. Palatal palsy.

26th day. Cardiac arrhythmia.

35th day. Ciliary palsy.

42nd day. Labial palsy.

49th-53rd days. Pharyngeal palsy.

54th day. Allowed to sit up, but it was a fortnight before he could walk by himself. The knee- and ankle-jerks were still absent on his discharge from hospital on the 72nd day.

CASE 11.—Boy, æt. 7, admitted March 5th, 1905, on 4th day of disease. State on admission : Fauces extremely œdematos. Thick membrane covers both tonsils and pillars, and is continued as a thin film almost on to hard palate. Adenopathy well-marked. Thick nasal discharge. Membrane visible in nostrils. Much foetor. 24,000 units. Adrenalin chloride m. x., 2 hourly.

5th day. Delirious in night. Bruise on left calf and back of left hand. 24,000 units. Albuminuria lasting till 31st day.

8th day. Liver 1 finger's breadth below ribs. Throat clean.

11th-12th days. Urticaria.

11th day. Palatal palsy lasting till 60th day.

15th-27th days. Cardiac dilatation and arrhythmia.

28th day. Ciliary palsy.

50th day. Squint, ptosis and diplopia.

Some motor paresis for a fortnight after he was first up in clothes.

Discharged after 78 days' stay in hospital.

CASE 12.—Girl, æt. 7, admitted at 12.15 a.m. on March 14th, 1906, on 5th day of disease. State on admission : Fauces œdematos. Thick membrane covers tonsils, anterior pillars, uvula, and part of soft palate. Watery nasal discharge. Stertor and foetor. Proconsular neck. Albuminuria persisting till 41st day. Babinski's sign in both feet lasting till 33rd day.

24,000 units. Adrenalin chloride m. x., 4 hourly. 1.20 p.m., 24,000 units.

6th day. Hæmorrhage from beneath membrane on palate.

7th day. Sanious nasal discharge.

8th day. Numerous petechiae on back and sides of thorax. A few round neck and in left groin. Punctate eruption on knees. Bruise on right iliac crest.

9th day. Hæmorrhage from fauces. Voice nasal.

11th day. Throat free of membrane. Extensive superficial necrosis of epithelium of tonsils, uvula, pillars, and soft palate.

12th day only. A few small wheals on abdomen.

25th day. Ciliary palsy.

33rd-49th days. Cardiac dilatation and irregularity.

40th-60th days. Labial palsy.

Transferred to convalescent hospital on 70th day of disease. No loss of power in limbs, but knee- and ankle-jerks absent.

CASE 13.—Boy, æt. 5, admitted April 1st, 1908, at 12.15 a.m. on 5th day of disease. State on admission : Fauces and palate œdematosus. Membrane covers tonsils, pillars, uvula, and soft palate. Profuse nasal discharge. Proconsular neck. 28,000 units. Adrenalin m. x., 4 hourly.

11.15 a.m. Much epistaxis. 24,000 units. Adrenalin increased to m. x., 2 hourly.

6th day. Bruise over tubercle of left tibia.

7th day. Bruises over right posterior iliac spine. Sanious nasal discharge. Albuminuria persisting till 44th day.

9th day. Throat clean.

12th day. Palatal palsy lasting till 52nd day. Heart sounds indistinct. Liver edge 1 finger's breadth below costal margin.

12th-13th days. A few small wheals on abdomen.

15th day. Urticaria on face and thighs.

21st day. Ciliary palsy lasting till 45th day.

25th-64th days. Cardiac irregularity and dilatation.

32nd day. Labial palsy.

76th day. In clothes. For a few days he was unable to walk without support. The knee- and ankle-jerks which were sluggish on admission were lost by the 32nd day and were still absent on his discharge on the 101st day.

It will be seen that all these cases showed the characteristic features of malignant diphtheria. In addition to severe angina, all but one had some degree of nasal involvement. Albuminuria was present in all. In 9 it was abundant, and lasted for more than three weeks.

All developed extensive paralysis. Palatal palsy occurred in all, in 4 it was precocious, *i.e.*, appeared before the beginning of the third week. All but two who were too young to test, showed ciliary palsy. All manifested some degree of cardiac dilatation and irregularity. In two there was cardiac vomiting. Ten showed considerable weakness of the lower extremities which persisted for a fortnight or more after first getting up. In two of the remainder though there was no actual loss of power, the knee- and ankle-jerks were abolished (paraplegic fruste of Aubertin and Babonneix. (a) Labial palsy was noted in 6, squint in 4, paralysis of the pharynx in 4, and of the diaphragm in 2.

The length of stay in hospital was considerably longer than the average, though only one patient (Case 3), developed a secondary disease—scarlet fever. The shortest stay was 62 days, the longest 97, and the average period, 80 days.

The treatment in each case consisted in large doses of antitoxin, the justification for which will be seen in Table III., and in the internal administration of adrenalin. This drug was given not so much for the sake of controlling the haemorrhages, which in no case were sufficient to endanger life, but to compensate for the suprarenal insufficiency, clinical and anatomical evidence of which exists in every severe case of diphtheria.

SUMMARY.

1. Cutaneous haemorrhages occurring during the early stages of the disease with or without haemorrhages from the mucous membranes and associated with other features of malignancy, occur in about 5 per cent., of all cases of diphtheria.

2. The severity of the diphtherial attack is usually due to neglect of treatment at an early stage, but is sometimes due to precocious malignancy (*cf.* syphilis).

3. Haemorrhagic diphtheria is confined to children. It is not affected by the season, sex, or previous health.

4. Reaction to antitoxin is delayed, and the usual sequelæ of serum treatment are much less frequent in haemorrhagic than in milder forms of diphtheria.

5. The mortality of haemorrhagic diphtheria is over 80 per cent.

6. All the cases which recover suffer from extensive paralysis.

7. Treatment should consist in large doses of antitoxin associated with frequent administration of adrenalin.